

about one-fourth the quantity of the sulphate of copper to the alum. Cloth made waterproof in this manner will resist the effects of water even if it is somewhat warm, but it loses its waterproof properties if boiled. Persons who are exposed to the inclemency of the weather, will find it to their advantage, as a means of preserving health to prepare their clothes in the way we have described. Several corps in the French army are provided with porous water-proof cloth tunics prepared in a similar manner. They have been found very beneficial when the troops are in active service.—*Sci. Amer.*

Subterranean Railway.

The Metropolitan (Subterranean Railway) Works were inspected in August by a party of the directors and other gentlemen interested in the undertaking, who passed through the entire length of the line from the junction at Paddington to within a few yards of the temporary station at Farringdon Street. The inspection commenced at the terminal station at Paddington, the construction of which is a difficult piece of work, arising from the confined and awkward nature of the ground on which the station has to be fitted on either side of the up and down lines of the metropolitan branch. At this point an artificial roadway is carried on girders to give room for a standing, and for an approach for cabs and omnibuses. The engine used on Monday was especially designed for the line by Mr. Fowler, the engineer of the company. It consumes its own smoke and condenses its own steam, and gives off neither smoke nor vapour when it once enters the tunnel. The carriages are lighted with gas on a simple and efficacious plan. In an india-rubber bag, on the roof of each carriage, the gas is inclosed, and feeds two lamps for two or three hours. This arrangement has been at work for some time on many of our northern lines and on the continent and has always worked with safety. When empty the bags are replenished in a few moments from an ordinary gas-stand pipe. The train proceeded at the rate of about twelve miles an hour—a speed that was seldom exceeded, from the constant stoppages to visit all the stations. The tunnel was perfectly clear, free from close air, dry, and well lit. The directors were perfectly satisfied with the result of their inspection. The line it is reported, will be open for traffic on the 1st of October.—*Mechanics Magazine.*

Mechanical Power of the Tides.

Let us suppose that by the action of the tides the difference of level of the surface of the ocean at a certain spot is 21 feet between high and low water; omitting for the present all consideration of the power of the subjacent liquid, what is the mechanical value of a space of 100 yards square of this water? 100 yards square by 21 feet deep equals 70,000 cubic yards of water, which is lifted to a height of 21 feet, or to 1,470,000 cubic yards lifted to a height of 1 foot. Now, since one cubic yard of water weighs about 1,683 lbs., 1,470,000 cubic yards weigh 2,474,010,000 lbs., which is lifted in six hours. This is equivalent to lifting a weight of 412,335,000 foot lbs. in one hour; and since one horse-power is considered equivalent in raising 1,800,000 foot lbs. per hour, we have, locked up in every 100 yards square of sea surface, a power

equal to a 230 horse-power steam-engine, acting, be it remembered, day and night to the end of time, requiring no supervision, and costing nothing after the first outlay but the wear and tear of machinery.

Different Glazes used for Cooking Utensils.

The wrought and cast iron vessels which are to be placed on the fire are often covered with enamel, which protects the liquid from metallic contact with the sides.

Two compositions are generally employed for this purpose, one having for its base silicate of lead and the other boro-silicate of soda. These enamels are applied to the scoured surface of the metal in the form of a powder, which is fixed by heating it to a sufficiently high temperature to fuse it; it then spreads over and covers the metal with a vitreous varnish.

The boro-silicate of soda enamel possesses great superiority over that of silicate of lead, for it is unattacked by vinegar, marine salt, the greater number of acid or saline solutions, even when concentrated, and resists the action of the agents employed in cooking or chemical operations.

The silicate of lead enamel is whiter and more homogenous, which explains the preference given to it by the public; but it gives up oxide of lead to vinegar or to common salt; it acts upon a great number of colouring matters, and it is attacked by nitric acid, which immediately communicates a dull appearance to it. On evaporation the liquid leaves a white crystalline residue of nitrate of lead. This enamel is instantly darkened by dissolved sulphides, and also by cooking food containing sulphur, such as cabbage, fish, and stale eggs.

It is very easy to distinguish these two enamels by means of a solution of sulphide of potassium, sodium, or ammonium. On allowing a drop of one of these reagents to fall on the vessel to be tested, the lead enamel darkens in a few moments, whilst the boro-silicate of soda enamel retains its white colour.—*Journal d'Anvers.*

Silvering Solution.

If one drop of solution of acetate or sulphate of morphia (1 per cent. strength) be mixed with ten or fifteen drops of a solution of nitrate of silver (four grs. to the drachm), and agitated for a minute or so, a fine white crystalline precipitate of frosted silver shortly takes place, the liquor acquiring a slight yellow colour from the reaction of the liberated nitric acid upon the morphia, and on decantation or filtration and the addition of strong nitric acid the usual orange-red colour of morphia is developed. If a white porcelain dish, containing the nitrate of silver solution, be slightly warmed previous to adding the morphia, the reduction is almost instantaneous, and the vessel coated with a film of silver.

Aurora Borealis.

M. De la Rive has recently communicated to the *Philosophical Magazine* some researches on this phenomenon. The fundamental points established are:

1st. The coincidence of the occurrence of aurora in the northern and southern hemispheres, particularly at Christiania and Hobart Town.

2nd. That the phenomenon is an atmospheric one.